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USSR Report

AGRICULTURE

(FOUO 1/82)

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REGIONAL DEVELOPMENT

ESTONIAN OFFICIAL INTERVIEWED ON FOOD PROGRAM GOALS

Tallinn SOTSIALISTLIK POLLUMAJANDUS in Estonian No 19, Oct 81 pp 722-724

[Interview with Gustav Tonspoeg, ESSR first deputy chairman of Council of Ministers, chairman of ESSR Gosplan; passages enclosed in slantlines printed in boldface]

[Text] [Question] /Our national economy, including agriculture, has been directed in a planned fashion. Why then do we now need a special food program?/

[Answer] There are several requirements for a food program. True, plans for social and economic development assign tasks to agriculture by five year and annual periods, they also determine resources to be invested in agriculture. National economic plans also assign tasks for those branches of production that are directly connected with agriculture /or influence its development/. But the tasks of the various branches of the agrarian-industrial complex have to date not been coordinated, they had to be accommodated to each other later, through special agreements, even though by far not all tasks were filled in a timely fashion. It happens that a branch of the national economy supplying agriculture meets its goals by the end of the five-year period, but that a large part of the production required by agriculture reaches the farmers only in the last years of the five-year period. The supplier has met his goals, but the farmer has not yet been able to use these resources. This has been the case with machinery, mineral fertilizers, and other supplies. Also, the farmer will get no production out of a facility received from the builders at the end of a year.

Goal-oriented complex programs constitute a method for planning in which the productive tasks of the various branches are coordinated in time and space, at the same time the connections have been worked out in greater detail and /with an eye on the longer perspective/. The need to establish a food program as a perspective plan derives directly from the decisions of the 26th CPSU Congress. The congress noted that the potential of the USSR national economy is sufficient to completely satisfy the people's food needs if comprehensive measures are taken. /The aim of the food program is precisely the meeting of the people's needs as rapidly as possible./

The aims of agrarian production for 1985 and 1990 were more precisely outlined at the 26th CPSU Congress; the goals fixed should be considered minimums. They

have to be considered a minimum program since their attainment does not yet guarantee the complete satisfaction of the people's needs.

The goal of the task is to guarantee meeting these goals and establishing ways to exceed the plans. This is the base for the central idea of the Central Committee of the CPSU and the USSR Council of Ministers directive regarding agrarian planning and perfecting of the economic mechanisms--stimulation and rewards are tied to /exceeding/ plans and previously achieved levels of production.

In other words, comprehensive plans are designed to secure a division of organizational work and resources that will establish favorable outlooks not only for meeting goals but also for exceeding them.

For example, during the 11th Five-Year Plan we have to produce an average of 11-13 percent more agricultural products than during the previous period. At the same time the tasks for supply and division of production have already been determined.

Agrarian products of our republic, primarily dairy products, are also used in the other federal republics. This is quite natural, since first, the immediate surroundings of million-cities (such as Leningrad) cannot produce enough food, and secondly the intensity of our dairy industry is greatly dependent on resources imported from other federal republics. According to plans we receive many resources from other areas--machines, mineral fertilizers, concentrated feed, oil products, etc--since we either do not have them or we produce them in insufficient quantity. On the other hand, we export products that we produce in greater quantity. Both the imported productive resources as well as the exported meat and dairy products have been fixed not in relative quantities, but in specific amounts in the plans. These quantities must be met without question. Only if we are able to mobilize all of our resources and meet each year the /state procurement quotas/ will we be able to meet the tasks of delivery into the all-union fund and at the same time provide our own inhabitants with animal products in a quantity approximating the physiological requirements.

[Question] /There is probably no need to comment on the main aim of the program, a better food supply. But does each worker see his part in meeting that goal, will that aim not be too remote for the enterprises?/

[Answer] After meeting the main aim it must be ascertained what factors influence reaching the programs. In the formulation of the first draft of the food program we determined the relations and proportions between the various branches of agriculture and between it and related branches of the national economy. For example, dairy production depends primarily on feeds. /But feed production/ is in itself a complex problem, including the structure, culture, growing areas and their structure, all involved in meeting basic protein needs with local feeds.

In establishing the food program we took into account several alternatives, with the most favorable one--i.e. one that permits us to produce more animal products in various field distribution configurations--to be selected later. These alternatives must still be weighed. Of course, it was also determined how much feed in both tons as well as feed units and feed components would be necessary to

produce the planned amounts of meat and milk. The proportions of various feed items (protein) and the volumes of the various kinds of feed are determined by the structure of animal products production.

All this coordination is no easy task. When our task is to supply a certain number of tons of meat, then we can meet the plan with either beef or pork. We need different kinds of feed to produce either kind of meat. Pork can be produced with a relatively smaller number of feed units, but a push of pork raising is dependent on imported concentrated feed, and, moreover, it makes more acute the shortage of protein and vitamin additives. Feed production, however, does not depend only on the proportion of various kinds of meat, but also /on the requirements for a rational use of land/ and simply on opportunities--the suitability of soils to raise this or another crop, the need for crop rotation, etc. A reckoning of all this within our republic is a momentous task which we are attempting to solve with the food program. /The rational development of feed production is, indeed, a subprogram of the food program./

/A second important subprogram includes grain production./ This involves those grain products that are used for immediate human consumption. In issues 7, 8 and 13 of SOTSIALISTLIK POLLUMAJANDUS this same topic has been thoroughly discussed and I need not restate what has been said there.

A third subprogram encompasses the /efficiency/ of agrarian production. This is primarily concerned with the efficient use of capital investments. Let me explain: We determined the structure of grain production on the basis of the needs of animal husbandry, the needs of grain production in turn influence greatly the need and structure of capital investments. We followed the same path in developing the food program.

A change in the structure of capital investments is reflected in plans for the next 5 years. For example, expenditures for melioration have been reduced. These funds will be primarily used to build barns and storage facilities, so as to reduce wastage, but especially for rural housing, so as to slow the migration of the rural population to the towns.

Here we also surveyed measures to assure that the total volume of products from /individual landholding/ not diminish. Probably the production of some items (such as milk) will decrease, but one must assure that the general volume of small production remain at least on the current level, and increase, if at all possible. We have planned for many incentives, distributed among state capital investments, individual resources, and the sale of tools and other necesary items.

[Question] /In the drafting of the food program some disproportions that hinder normal development of production have become apparent. The basic goals were fixed before the food program. Are the tasks included in them still realistic?/

[Answer] Although the current year was one of very intensive work I can assure you that the /tempo of growth planned for the current five-year period is realistic/. Let us look at some facts--in 1976 we produced 1,140,000 tons of milk in our republic, 1,040,000 in 1979. In 1980 it was 1,090,000 and this year's goal

is 1,155,000 tons, or only 15,000 tons more than 5 years ago. Next year, however, the volume to be procured increases only by a few thousand tons. This year the rains did not let us make sufficient hay and in places the soil did not support machines and animals, so that one can fear that milk production might be somewhat less than the plan for this year. But still, we cannot say that the procurement tasks for this five-year period would be unrealistic, unachievable. The fact that milk production has decreased due to the convergence of several factors out of the control of the farmer does not represent a pattern, but only an exception to the rule.

Our main task then is to compile a program that would permit the meeting and surpassing of goals in the near future. For this purpose we must direct our efforts correctly and place resources so as to increase production. First off, this meant that land, material resources, money, and labor be utilized considerably better.

How much production should increase I cannot state in numbers, since that program has not yet been finalized.

[Question] /Production in the Estonian village of today is ever more dependent on social factors. Does this echo in the food program, and if so, how?/

[Answer] The most important component of the elements of production is the human being. For this reason the food program includes means for social development. Taking into account realities we attempt to find possible better solutions for man's working and environmental conditions. /Neither medical, cultural, or environmental services of the rural inhabitant should be worse than in the towns./ The development of services in the countryside must take into account the social structure, demographic peculiarities, etc of the rural population.

The food program includes also the incorporation of /the resources of other branches of the national economy/ in the social development of the countryside. Apparently the resources of the other branches of the national economy should be included in strengthening the social and productive infrastructure in the countryside. Also, it is high time to think how the town could better help the country with qualified labor in seasonal work. For example, it would be good if students in urban vocational schools would be taught how to drive tractors. Agriculture and the entire food industry is /the most important branch of our republic's economy/ and the food program ties the interests of the other branches to the development of agriculture.

I cannot yet say what measures should be used to further increase the interest of other branches of the national economy in furthering agriculture. But already initiatives in that direction have been taken by several ministries. Several ministers have advanced the possibility that their enterprises in rural areas be placed on an 8 or 10 month pay schedule. This would enable the workers to work on the farm for some months. Such measures can be included in the food program as well and would result in raising agrarian qualifications of laborers in rural plants. This would also considerably reduce the shortage of labor during peak seasons.

One must applaud the suggestion of the ESSR Truck Transport and Highway Ministry that it incorporate the local road maintenance into the republic's road network and include some roads within enterprises in the rayon road network. This would mean that the roads would be maintained and repaired not by enterprise labor but with state resources, and the enterprises could deal more with their basic tasks.

Agriculture receives assistance from elsewhere as well. For example, in 2-3 years we will fully meet the needs for peat by the kolkhoz and sovkhoz. This in turn requires extensive revision of trucking enterprise's work schedules, so that the peat would reach the consumer at the right time. All of this can be coordinated within the food program.

Within the food program we also include the development of auxiliary labor in the enterprises. There are many people who for health or other reasons cannot work specifically in agriculture, but can do so in auxiliary branches.

The development of auxiliary labor would also contribute to increasing the labor efficiency of the rural population and would offer suitable work for women. There are areas where we have considerably more men than women. Auxiliary labor would help to keep the women in the countryside and would thus solve an important social problem. At that same time, auxiliary production should in peak season be the most important and most convenient source of additional labor for harvesting or other pressing tasks. For this reason personnel in auxiliary production should also be trained in agricultural skills.

Incorporating the development of auxiliary production into the food program also has the aim /that the production of any kind of auxiliary enterprise should meet the needs of this republic's rural and urban population/ and not be directed to profiteering in other federal republics.

I don't suggest that auxiliary production in a kolkhoz should be limited only to making maltose, starch or cabbage. Surely the people in the countryside will be able to handle more complex production that is needed by the population. The needs of the people are growing, where a simple hammer or screwdriver used to suffice, now there is a demand for electrical hand tools. I think that the enterprises would be able to produce them if they would have cooperative agreements with industrial plants.

The food program is concerned with working conditions and improvements in medical services. Sick people must be well treated in the countryside also, but it is more important that a person not become sick, that preventive medicine be practiced, that working conditions be improved, that each rural inhabitant be guaranteed a good lunch, opportunities for rest, etc, so as to reduce sick leave which is currently excessive. Tractor operators are sick more than others; their diseases are well known. Apparently sickness could be reduced if the operators were offered invigorating activities that would improve their physical fitness. As far as I know not a single enterprise has bothered with that. There is also often a failure to see that the tractor operator's health is threatened by a dilapidated driver's cabin, poor working clothes, the lack of washup facilities, etc, etc. People do not want to see that it is wiser to abandon one maintenance bay and build a decent washroom than to save on account

of an operator's working conditions. But later there are complaints about a lack of operators and their volatility.

But the entire fate of the food program depends most /directly and decisively/ on that very tractor driver, his remaining in the country or moving to town.

[Question] /Long-range programs include in addition to goals, means, and limitations also management structures. What would you say about that latter point?/

[Answer] Indeed, the food program includes organizational tasks, management, especially on the rayon and enterprise level. The current management habits in our rayons and enterprises are not satisfactory. Analysis shows, for example, that a tremendous amount of time is expended in the enterprises in hauling workers to the job and back. Also, much time is used to bring machinery to the field. Since enterprises are large, more machines should be in the hands of departments, so that the department would be much more mobile than now. The chief agronomist should rule over special machinery, but the self-managing department should be lord over other machinery. An increase in the importance of departments would also decelerate urbanization and help to improve the population dispersal in the country. But an immediate profit would accrue from the vast reduction of shuttle runs. Currently, the main job of many people consists of hauling other people. In addition, there is the depreciation of vehicles, fuel costs, etc. All of these expenditures are by far not unavoidable.

Also, I would like to stress the need to improve stimulation, it being a most important tool.

In an increasing measure such remuneration systems must be implemented that would relate the end result of labor more to salary and bonus. Through his remuneration each person must better realize his part in the accomplishments of the enterprise. Currently, the bosses often receive the bonuses, while the actual laborer might even go without one. A manager at any level should not receive a bonus for individual work but rather for the final results. Such a system must be developed. Currently we are too stuck in old habits and in measuring quantity. Today the quality evident in the final product must be taken into account in an increased fashion.

I would like to stress, the goal-oriented program helps to connect the interests of agriculture and peripheral branches of the economy and to increase the interest of all segments of the food complex in the final results. Of course, right now we do not have a mechanism for coordinating these interests. I would hope that it be developed soon.

[Question] /You have explained several aspects of the food program and also what must still be solved with the help of that document. How far has the compilation of the program proceeded?/

[Answer] At this time the first draft of the republic's food program is between covers. It is an extensive, voluminous job, in which many experts participated. Edgar Tonurist, director of the Estonian Agrarian Institute, chaired the committee in charge of producing the food program. Our well-known farmers, such as

the chief agronomist of the "Edasi" kolkhoz of Parnu Rayon, Arnold Erm, the director of the Laatre sovkhoz of Valga Rayon, Huno Toomiste, the director of the Turi exhibit sovkhoz, Uudo Kalamann, Leonard Kallas of the "Vambola" kolkhoz of Viljandi Rayon, etc, made their contribution to the development of the food program. The committee included representatives of Gosplan, the Ministry of Agriculture, the Ministry of Meat and Dairy Industry, the Ministry of Food Products, the Ministry of Procurement, the labor committee and the EPT, as well as scholars of the Institute of Economics of the ESSR Academy of Sciences, the Estonian Herding Institute, Estonian Agrarian Institute, and the Estonian Academy of Agriculture.

We collected very much material, containing interesting analyses and suggestions. The extensive material was reduced and concentrated into the first draft of the food program--consisting of two pamphlets with some 150 pages all told.

The food program of our republic will get its final shape after all the resources we are to receive from the state have been ascertained.

Many questions cannot be solved within the borders of our republic. We do not produce several products necessary to agriculture and it would not be efficient to establish such means of production locally. We also made several suggestions to the USSR Gosplan to improve the use of the enterprises' stimulation funds, to increase bank credit, etc.

The food program of our republic will become an organic part of the food program of the USSR and it will become the foundation for plans for social and economic development of our state. It would not be efficient to compile a food program for a level below the republic. The framework of an area or rayon is too small, the resources come from elsewhere and it would make no sense to tie all local questions in their detail to a grand program. The goals and programs of the enterprises are contained in their five-year plan and in the measures envisioned to meet that plan. The enterprises must compile their five-year plans by November, benchmark figures for that task have been in their hands since September. These benchmark figures reflect procurement tasks and resources that will be available to the enterprises. The enterprises must themselves find the most rational means to meet their obligation to society (the plans of sale to the state) in the best way.

I repeat--the food program of our republic is the foundation for compiling a food program for the USSR. The food program for the entire country should be finished by the end of the year, and after that some revisions must apparently be made in the food program of our republic. Then the food program will become a directive document, a law whose fulfillment will be demanded and checked.

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AGRO-ECONOMICS AND ORGANIZATION

CONFERENCE ON APK PROBLEMS HIGHLIGHTS PRIORITY OBJECTIVES

Moscow VOPROSY EKONOMIKI in Russian No 10, Oct 81 pp 155-157

[Article by V. Balabanov: "Conference of the Scientific Council for Economic, Social and Legal Problems of the USSR APK"]

[Text] The first conference of the Scientific Conference for Economic, Social and Legal Problems of the USSR APK [Agroindustrial Complex], which convened from 25 to 27 May 1981, was devoted to discussing the methods to be employed for carrying out the tasks of the food program.

The principal report, entitled "Development and Implementation of the Food Program in Light of the Decisions Handed Down During the 26th CPSU Congress," was delivered by the chairman of the scientific council, VASKhNIL [All-Union Academy of Agricultural Sciences imeni V.I. Lenin] Academician V. Tikhonov. Having taken note of the achievements realized in developing the country's agrarian economy, he described the principal trends in the development of agriculture as a central element in the development of the food complex.

At the present time, there are 43 million individuals working within the APK structure, the bulk of the annual net product being produced exceeds 167 billion rubles (more than 41 percent of the annual national income) and the value of the surplus product created in branches of the APK amounts to 95 billion rubles (47 percent of the annual mass of surplus product created in the country). In examining the dynamics of production by five-year periods, it can be seen that agriculture is developing in a rather dynamic manner. Nevertheless, irregularities in the volumes of production occur from year to year and this brings about corresponding phenomena in the processing industry of the APK. The level of development of the logistical base for branches of the APK infrastructure and the processing industry is clearly inadequate. As a result, losses in the production of agricultural raw materials are increasing and the consumption level for certain types of food goods is increasing at a slower rate than their production volumes.

The principal trends for further development of the APK were revealed in the report and they are reflected in the food program as developed: scientific-technical progress and improvements in the structure of agroindustrial production; improvements in the economic mechanism and stable economic orientation of all branches of the APK towards maximization of the final results. These trends are considered to be of a priority nature with regard to capital investment policy

both during the current five-year period and in the future. In the opinion of V. Tikhonov, greater importance is attached to the second trend under modern conditions. Further improvements in the structure of agroindustrial production assumes first of all the development of the production apparatus of those branches engaged in the procurement, transporting, storage and processing of agricultural products and also delivering the final products to the consumer. According to computations cited in the report, the implementation of the program for the accelerated development of the mentioned branches will make it possible to increase considerably the yield of final product obtained from each unit of agricultural output produced and particularly by reducing and preventing losses in such output during the "post-agricultural stage."

The speaker singled out the following priority trends in the sphere of changes in the structure of agricultural production:

1. Regulation of the logistical base for agriculture and the establishment of optimum proportions among its component parts.

2. Improvements in the structure of the grain economy (absolute and relative increase in new energy-saturated and high protein grain crops, with stabilization and even a slight reduction in the production of bread grain).

3. Improvements in the structure of animal husbandry, based mainly upon the development of such branches as meat poultry raising and swine raising and also upon the accelerated development of beef cattle husbandry as a relatively independent branch. In taking note of the need for developing feed production and converting it over to an industrial basis, V. Tikhonov emphasized that the solving of the feed problem is definitely dependent upon the structure of animal husbandry.

4. Improvements in the regional structure of agricultural production. This trend is based upon the principle of forming specialized zones for the production of the principal marketable products.

It is assumed that the program for distributing agricultural production by zones should be coordinated with the tasks for bringing the production of the principal marketable products closer to the areas where they are consumed and to those regions possessing the most favorable objective natural-climatic and soil conditions for the cultivation of the particular type of product. Such a distribution program for agricultural production will require appropriate development of the road-transport system, the storehouse economy, the processing industry and installations of the social infrastructure in the specialized regions. In this regard, special attention must be given to the erection of wholesale bases for the storage of raw materials and to the development of the processing industry in the regions of concentrated production for each type of product.

5. Improvements in the structure of capital investments in agriculture. In the opinion of the speaker, the investment policies aimed at developing agriculture must single out and substantiate trends which will bring about a real reduction in the periods for the repayment of capital investments, by means of surplus product created in agriculture.

A portion of the report was devoted to the problems concerned with improving the economic mechanism. Here, in the opinion of the speaker, a great role is to be played by more extensive use of contractual arrangements among branches, associations, enterprises and regions. These contracts, which are organically combined with the planned economy system, must provide for mutual economic advantages for each of the partners and also for their mutual responsibility for the accurate fulfillment of obligations.

In examining the problems concerned with price formation, V. Tikhonov emphasized the need for employing uniform principles in the formation of prices for all products of APK branches, which serve as objects for inter-branch exchange.

A considerable amount of attention was given in the report to organizing the system of economic incentives for enterprises, subunits and economic workers at all levels. This system, according to the speaker, must meet the following requirements: at all levels the incentives work in a unidirectional manner; they are well defined and operate automatically when a definite goal is achieved; the amount of incentive is proportional to the result (goal) achieved and it has no limitation with the exception of the degree to which the goal was achieved. Kolkhoz and sovkhoz practice over a period of many years has shown that these requirements are met by a collective form of wages and material incentives known as the job contract plus bonus system with periodic advances.

In conclusion, the speaker discussed the course of work on "Proposals by the USSR Academy of Sciences on Developing the Country's Food Program."

Doctor of Laws M. Kozyr' (head of a section on legal problems associated with the development of the APK), in his report, noted that legal influence on the development of the APK is associated with further improvements in that legislation which defines the legal status of agricultural and agroindustrial enterprises and associations and the legal status of organs of control; with the regulation of legally acceptable activity, the shortcomings of which are explained to a considerable degree by the illegal imposition, upon agricultural enterprises and associations, of tasks not called for in the state plans for the economic and social development of the USSR and the union republics. In addition to planning, an important role in the economic mechanism of the APK is played by an economic contract. A considerable expansion has taken place in the number of contractual arrangements among agricultural enterprises and it is expected that this trend will continue in the future. For it is precisely an economic contract that establishes the equality of the parties and their mutual property responsibility for failure to meet the obligations and it can become an effective economic-legal instrument and an organic component part of measures aimed at restoring the principle of equivalence in commodity-monetary exchange and in evaluating the level of services of various echelons of the agroindustrial complex. An important condition for improving contractual relationships between agricultural enterprises and associations with other APK partners is that of establishing efficient legal control over them, as is being done in industry based upon statutes approved by the USSR Council of Ministers.

Information on the operational plan of the scientific council was furnished by scientist and secretary of the council, V. Balabanov.

Candidate of Economic Sciences L. Nikiforov (head of a section on social problems associated with development of the APK), in his report, singled out a number of problems concerned with obtaining the resources required for the socio-economic development of the rural areas (financing, materials and so forth). The speaker discussed the role played by the rural areas in solving the food problem, in the production of consumer goods and in obtaining additional resources. In his opinion, an improved attitude towards the regions, not only the administrative-territorial but also the economic-organizational units, will ensure the complete utilization and development of the potential existing in the regions. Among the conditions which determine the complex development of a territory, L. Nikiforov singled out the following: the solving of a number of national economic problems by local economic organs; the development of all-round special purpose programs for the development of a territory or branch; taking into account the peculiarities of regions from the standpoint of the kolkhozes and sovkhozes located within them (in those areas where sovkhozes predominate, state funds are invested for development of the social infrastructure).

The speakers during the conference unanimously agreed that the agroindustrial complex requires a single control, since it is of an interbranch nature; only a special organization, one that has been given extensive rights, can provide this single control.

Candidate of economic sciences and deputy head of a department at USSR Gosplan N. Smetanin discussed the preparation of the food plan by USSR Gosplan. Information on the work of the Food Goods Committee of the USSR Academy of Sciences was provided to the conference by scientist and secretary of the committee, Candidate of Economic Sciences M. Polyakov. The deputy chairman of the VASKhNIL council, Doctor of Economic Sciences I. Kurtsev, delivered a report on the work of the VASKhNIL Council for Economic Relationships Between Agriculture and Other Branches of the Agroindustrial Complex.

More than 20 individuals, representatives of the USSR Academy of Sciences, scientific research organizations, VUZ's and planning and branch institutes, participated in the debates over the reports rendered.

7026
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TILLING AND CROPPING TECHNOLOGY

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PROBLEMS OF MICROFERTILIZERS IN USSR CROP FARMING DISCUSSED

Moscow AGROKHIMIYA in Russian No 10, Oct 81 pp 146-153

[Article by B.A. Yagodin: "Problem of Microfertilizers in USSR Farming"]

[Text] The intensive use of chemical processes, through mineral fertilizer applications, produces no less than one half of the increase in cropping power obtained. In view of the increasing investments in agricultural production, extreme importance is attached to achieving high agronomic and economic effectiveness from the use of mineral fertilizers and also to displaying concern for the quality of the agricultural output. In solving the problems associated with further raising the cropping power of crops, while simultaneously raising the cropping power of the crops, special importance is attached to ensuring that the plants are provided with all of the required elements of mineral nutrition and in the correct and scientifically sound manner. In those instances when the plants are supplied with adequate amounts of N, P, K, Ca and Mg, growth in the yields obtained may be limited not only by the potential of a particular variety, the intensity of illumination or the amount of moisture, but also and quite often by a deficit of individual microelements.

A deficit of microelements in the soil often brings about a reduction in yield and a deterioration in the quality of the crop, a number of plant diseases and quite often it can result in the destruction of the plants. The use of appropriate microfertilizers not only eliminates the possibility of diseases, but in addition it ensures higher and better quality yields for the plants.

The theoretical principles underlying the use of microelements, which are highly developed at the present time, became universally recognized only when the presence of microelements in various fermentation complexes was established.

The positive effect generated by microelements is conditioned by the fact that they participate in the reduction-oxidation processes and in carbohydrate and nitrogen exchanges and they raise the resistance of plants to diseases and unfavorable environmental conditions. Under the influence of microelements, the chlorophyll content in leaves increases, the photosynthesis process is improved and the assimilating activity of a plant is intensified. A tremendous role is played by the ability of many microelements to create an infinite number of compounds having organic substances. A majority of the microelements result in the appearance and unfolding of a number of biological processes. Quite often they are active centers for ferments and vitamins [1, 2]. For example, molybdenum is a part of two

ferments: nitrate reductase and nitrogenase, participating accordingly in a transfer of electrons during the process of nitrate restoration and the fixation of molecular oxygen of the atmosphere [3-5]. Copper, a part of many ferments (citrochromoxidase, polyphenoloxidase, Xanthineoxidase and others), participates in the transfer of electrons in reduction-oxidation reactions, during the oxidation of an entire series of compounds, in the photosynthesis process and in nitrogen, auxin and nuclein exchanges. The role played by copper in photosynthesis is obviously not limited to its inclusion in the structure of plastocyanine or low-molecular copper-containing protein, localized in chloroplasts, and which participates in the transporting of electrons I and II by photochemical systems [6]. In all probability, copper also participates in the reaction associated with the separation of oxygen.

The functions of zinc in the metabolism of plants are very diverse. Owing to its inclusion in carbonic anhydrase, malatdehydrogenase, alkali phosphatase and other ferments, zinc participates in the reduction-oxidation reactions of respiration, in nuclein and auxin exchanges and in regulating the synthesis of ATF [adenosine triphosphate]. Zinc influences the synthesis of auxins through its participation in the synthesis of tryptophan [1].

Manganese participates in a number of reduction-oxidation processes of photosynthesis and respiration, in the biosynthesis of RNK [ribonuclease],DNK [deoxyribonuclease] and indolylacetic acid, in the reduction of hydroxylamine to ammonia and in the hydrolysis and transfer of groups in a carbohydrate exchange and it is included in the structure of some dehydrogenases, Hydroxylamine reductases and glutaminetransferases.

In addition to the importance attached to studying the role played by microelements in various fermentation systems, it should be noted that it would be wrong to reduce their role to merely participating in the fermentation processes. Successes achieved in the field of molecular biology have underscored the one-sided and limited nature of such an approach. Microelements are capable of forming complexes containing nucleic acids and of influencing the physical properties, structure and physiological functions of ribose [1]. Some well known facts concerning the role played by microelements are not limited only to their fermentation activity. For example, boron is not included in the structure of any ferments and yet the physiological role played by this microelement is considerable. As is known, it is absolutely required for many plants and it participates in the exchange of auxins and phenol compounds [1]. Observations are available attesting to the need for boron during the initial stages of phosphorus absorption by pulse plants.

It is known that cobalt is not included in the structure of nitrogenase, a ferment which carries out the reduction of molecular nitrogen. However, the participation of cobalt in the nitrogen fixation process has been borne out by numerous observations. Cobalt also participates in protein, nucleic and energy exchanges [2].

The use of microfertilizers, by improving the balance in mineral nourishment for the plants, serves to increase considerably the size of the yields, it improves the quality of the products and it raises the resistance of plants against diseases, low and high temperatures and drought conditions [7-9].

Since the middle of our century, agrochemistry has taken a new and great step forward coincidental with greater emphasis being placed upon the practical orientation of studies conducted in the field of microelements.

However, many examples can be found of insufficient attention being given to the use of microelements in agricultural practice. This includes the rotting of beet hearts, rosetting of fruit, a number of grain crop diseases and cobalt deficiency in animals. In addition to causing shortfalls and spoilage in agricultural products, failure to devote proper attention to microelements can also serve to lower the efficiency of people and shorten their life span, as a result of poor nutrition.

It bears mentioning that it will be impossible to further intensify agricultural production in the future if use is not made of microfertilizers. This is based upon the fact that: 1) a further increase in the use of mineral macrofertilizers leads to an increase in the requirements for microelements; 2) high yields require the availability of new and very efficient plant varieties; in turn and in order to take advantage of the high potential and guarantees for stable yields, the new varieties should be provided with all of the required nutrients, including microfertilizers; 3) the use of highly concentrated nitrogen, phosphorus and potassium fertilizers, owing to the improved purification and absence of impurities in their microelements, increases the agricultural requirements for microfertilizers; 4) extremely high dosages of nitrogen, phosphorus and potassium produce an unfavorable ion balance in the soil solution for the microelements and thus their absorption capability deteriorates.

It bears mentioning that during this modern stage in the study of microelements, the researchers are devoting greater attention to those microelements which were not studied earlier from an agronomic or physiological standpoint: iodine, lithium, ammonia, vanadium, titanium, selenium, silicon, rubidium, bromine and fluorine. It is hoped that in the near future the researchers will establish the need for and the specific role to be played by the new microelements in the vital activities of plants.

Moreover, we are of the opinion that special attention should be given to revealing the primary action of a particular microelement, such that we do not become entangled in a multiplicity of subsequent reactions. We believe that a stage has arrived in the study of microelements wherein thorough theoretical studies that are based upon a detailed knowledge of a particular physiological process are justified, together with agrochemical works concerned with optimizing the system of mineral nutrition.

An important problem associated with the theory and practical use of microelements is that of determining the requirements for them of various organisms. For example, pulse plants contain considerably more molybdenum and accumulate 2-10 times more iron than do cereal grain crops [3, 10]. Pulse plants require cobalt fertilizers to a greater degree than do other crops [2, 11]. The different requirements for microelements among various plants, microorganisms and animals require thorough study. This is especially important in light of the use of microelement supplementary feedings in poultry and animal husbandry and subsequent use of organic fertilizers, with solutions being found for the problems of a balance in elements and environmental protection.

One criterion for the degree to which plants should be supplied with microelements, and hence the need for applying the appropriate microfertilizers, is their content in the soil. In the process, the most important consideration here is not the overall (gross) quantities of individual microelements in the soil, but rather their availability in mobile forms. Indeed, these forms determine to a certain degree the accessibility of the microelements for the plants. The quantity of microelements in mobile form quite often amounts to 10-15 percent of their overall content in the soil -- for Cu, Mo, Co and Zn and 2-4 percent for B. In addition, in order to evaluate correctly the degree to which the plants are supplied with microelements from the soil, one must necessarily take into account such rather complicated phenomena as their synergism and antagonism.

The important role played by microelements in raising the productivity of crops and the ever increasing requirements for them have raised the task of ensuring that agricultural production is supplied with promising forms of microfertilizers, forms which will make it possible to utilize these nutrients required for the plants in a more effective manner. An absolute deficiency of individual microelements, in addition to a low content of their forms in the soils that are accessible to the plants, may be if not the only one then at least one of the principal factors restraining growth in the crop yields. It is sufficient to mention the copper deficit in peat bogs, molybdenum -- in acid sod-podzolic and grey forest soils, boron and molybdenum -- in krasnozem soils, manganese, iron and zinc -- in carbonate-containing soils and an entire series of microelements in low-fertility sandy and sandy loam soils. The use of microfertilizers in these instances ensures an improvement in plant growth and development, an increase in the crop yields (and quality), especially crops which are sensitive to a deficit in the respective microelements. In accordance with the results obtained from a network of geographic experiments, an application of copper fertilizers to peat bog and light sandy loam soils results in an increase in grain crop yields of 2-5 quintals per hectare. According to the data obtained from numerous field tests, the average increase in yield for peas following the use of molybdenum on sod-podzolic and grey forest soils and also leached chernozem soils is 2.6 quintals per hectare; hay and clover seed on sod-podzolic soils -- 13 and 0.8 quintals per hectare respectively [12]. The use of boron on soils that are poor in terms of this microelement raises a yield of flax straw by 2-3 quintals per hectare, sugar beets by an average of 45 quintals per hectare, with a simultaneous increase in the sugar content in the roots of 0.3-2.1 percent and it increases the yields for other crops. On chernozem soils in the Ukrainian SSR, the increase in sugar beet yields following the use of manganese fertilizers is 10-15 quintals per hectare, with the sugar content in the roots increasing by 0.2-0.6 percent; an increase of 1.5-3.0 quintals per hectare takes place in the case of grain crop yields, including winter wheat [13].

In connection with the intensive use of chemical processes in agriculture, systematic increases in the crop yields are accompanied by the withdrawal of all mineral nutrients, including microelements. This raises the need for employing microfertilizers on soils having an insufficient content of microelements and it raises their significance even in regions where the content is only moderate.

A deficit of individual elements in the soils precludes the possibility of obtaining a full return from the use of nitrogen, phosphorus and potassium

fertilizers and an application of microfertilizers ensures a considerable increase in the effectiveness of mineral fertilizers which contain the principal plant nutrients.

It should be noted that the chemical industry in our country is presently producing only boron microfertilizers: boron-manganese fertilizers and boron superphosphate. Our industry is not producing the copper, molybdenum, manganese, zinc and other microfertilizers required for plants in a number of regions throughout the country. Agriculture is forced to employ various industrial waste products in the capacity of microfertilizers. These waste products either contain a low percentage of microelements, or they contain the latter in a form that is difficult for the plants to assimilate. Some of the waste products, with the exception of ballast, also contain harmful impurities (strontium, lead, mercury) which tend to bring about a deterioration in the quality of the plant products.

The principal regions for the effective use of boron, molybdenum and copper fertilizers are the northwestern, central, Volgo-Vyatsk and Urals regions of the RSFSR, the Baltic region, BSSR and UkSSR; the principal regions for the effective use of zinc and manganese fertilizers -- UkSSR and Central Asia, zinc fertilizers -- the north Caucasus.

Computations carried out at NIUIF [Scientific Research Institute of Fertilizers, Insecticides and Fungicides imeni Ya.V. Samoylov] and VIUA [All-Union Scientific Research Institute of Fertilizers and Soil Science] reveal that if microelements are applied to a limited area during the 1981-1990 period, the overall requirements of farming throughout the country will be as follows for this period: B 3000-4800, Mo 700-1500, Cu 2200-6000, Mn 7000-10000, Zn 600-650, Co 200-600 and I 200-400 tons annually.

The satisfaction of these requirements calls for an increase in the production of boron superphosphate and also the organization of the production of new forms of microfertilizers, obtained on the basis of single and complex fertilizers.

It bears mentioning that the computation cited is extremely conditional; it does not take into account the requirements of animal husbandry, forestry or the fertilization of meadows and pastures with microelements. Considerable quantities of microfertilizers are required for the raising of high-grade vegetables under greenhouse conditions. An increase will take place in the microfertilizer requirements owing to the carrying out of extensive land reclamation work. With further growth in the culture of farming and increased productivity in agricultural production, a requirement will arise for applying microfertilizers to the entire area of arable land and also to employ them extensively on meadows and pastures, in greenhouses, animal husbandry and in medicine.

A need has developed for substantially improving the supply of microfertilizers to be used for agricultural purposes. In solving this problem, considerable importance is attached to the production of mineral fertilizers containing microelement additives. The use of such fertilizers will make it possible to ensure their high agronomic effectiveness and also to reduce substantially the labor expenditures required for separate applications of the microelements and the principal

fertilizers. In addition, agriculture must be supplied with microelements in the form of technical salts for the carrying out of foliar top dressings and also for the pre-sowing treatment of seed. Since the microelements B, Mo, Cu, Mn and Zn are of the most practical value to agriculture, priority importance should be attached to the production of these microfertilizers. Agriculture also requires cobalt and iodine microfertilizers.

The extensive introduction of scientifically sound recommendations for the use of microelements in agriculture, recommendations which have been checked on the basis of many years of experience and which ensure a considerable increase in the productivity of field crop husbandry (and also animal husbandry), is being restrained by the limited scale of production and by the absence of a proper assortment of microfertilizers in our country.

The results of numerous scientific studies on promising microfertilizer types and forms underscore the advisability of producing and employing base fertilizers that have been enriched with microelements, including complex fertilizers. According to available forecasts, the agricultural requirements for microelements in the future must be satisfied 60-70 percent by microelements in the structure of complex fertilizers and 30-40 percent -- by means of technical salts, employed for foliar top dressings and pre-sowing treatment of seed. The use of various production waste products in the form of microfertilizers must be of limited importance and permissible only if the microelements contained in them have a high assimilability and if no impurities are present that could be toxic to the plants, animals or man.

A requirement exists for organizing the production of equipment which will make it possible to distribute small quantities of microfertilizers over a considerable area. This will make it possible, without having to expand the assortment of complex fertilizers, to ensure differentiated applications of microfertilizers in a number of regions throughout the country.

It is obvious that a high microelement effectiveness can be obtained only if the crops under cultivation require them and thus importance is attached to ensuring a correct distribution and intelligent use in agriculture of fertilizers containing microelements.

Under the conditions imposed by the intensive use of chemical processes in agricultural production, special importance is attached to the problem of balanced plant nutrition in terms of all of the required nutrients and to studying the interrelationship between micro and macroelements in nutrition and plant metabolism. The requirement for balanced nutrition in terms of elements, for the purpose of ensuring maximum yields of high quality agricultural products, not only does not eliminate but to the contrary it intensifies sharply the need for a strictly differentiated approach for applying microfertilizers, while taking into account the need for supplying the soils with accessible forms of the microelements, other soil-climatic factors and the biological peculiarities of crop nutrition.

The use of a broad selection of microelements, in combination with macroelements, in the structure of complex fertilizers or nutrient mixtures must be extremely limited and permissible only in those instances where there is an absolute nutrient deficit in the cultivation of plants on low-fertility sandy and sandy loam soils,

in hydroponics or on sheltered ground involving the use of inert low-buffering mediums, in floriculture and in ornamental gardening.

Mention should be made of the fact that in the case of systematic use of high organic fertilizer norms, an increase as a rule takes place in the content of gross supplies and mobile forms of microelements in the soil. However, the use of organic fertilizers obtained from farms where individual microelements are employed as additives to the livestock and poultry feed requires a careful selection of the possible norms in each individual instance. The use of liming and high mineral fertilizer norms exerts a substantial effect on the accessibility of microelements for plants. It is known that the increase which takes place in the content of mobile phosphates in the soil, during the systematic use of high phosphorous fertilizer norms, brings about a reduction in the accessibility of zinc to the plants. In turn, when the plants are supplied with sufficient amounts of such microelements as copper, zinc and molybdenum, an improvement takes place in the availability of phosphorous to the plants. A large amount of data is available attesting to the fact that molybdenum improves considerably the use of nitrogen contained in fertilizers and also the soil. Applications of high nitrogen norms for various crops bring about an increase in the requirements for molybdenum, copper, boron and cobalt.

In connection with the implementation of an extensive land reclamation program for acid soils, an increase will take place in the crop requirements for boron, copper, zinc, cobalt and manganese, while at the same time the requirements for molybdenum and vanadium will decrease.

A change in the reaction of the medium caused by physiological acidity or alkalinity of the mineral fertilizers can exert a considerable effect on the mobility in the soil and accessibility to the plants of the microelements.

When use is made, in the capacity of local fertilizers, of the waste products of industrial production, composts obtained from municipal garbage, sewage sludge and high norms for liquid farmyard manure, a danger arises of individual microelements (including heavy metals) accumulating in the soil and being included in the biological cycle, in concentrations considered to be toxic for plants, animals and man. Under conditions involving constantly increasing norms for the use of nitrogen fertilizers, serious attention should be given to the use of microelements which participate in the reduction of nitrates and other processes associated with the assimilation of nitrogen by plants, for the purpose of raising the effectiveness of the nitrogen in fertilizers and lowering the danger of nitrates accumulating in agricultural products and their contamination of water resources, including drinking water.

The exceptional role played by microelements in nitrogen fixation processes and the tremendous importance of biological nitrogen for solving the problem of food and feed protein production and in the nitrogen balance in farming require that priority attention be given to studying the mechanism of microelement participation in nitrogen fixation and to developing methods for raising the amounts of autotrophic nutrition for pulse crops and symbiotic fixation of molecular nitrogen using microfertilizers [3].

The modern status of the problem of microfertilizers is characterized by persistent attempts to understand the mechanism of microelement action and, on this basis, to solve the problems associated with their practical use in a scientifically sound manner.

Special attention should be given to those studies being undertaken in the field of microelement agrochemistry, the solving of which is of priority importance with regard to the practical use of microelements in farming and also for ensuring their high agronomic and economic effectiveness. This includes: 1) the development of reliable methods for forecasting the effectiveness of microfertilizers, based upon an agrochemical analysis of soils for the content of accessible forms of microelements and plant diagnosis; 2) a study of the action of promising forms of microfertilizers, with regard to the size and quality of yields for the more important crops, in the network of geographic field tests carried out using a common method and program, against a background of increasing dosages of the principal mineral fertilizers; 3) a study of the balance in macro and microelements during extended field tests with fertilizers, in crop rotation plans for various soil-climatic zones throughout the country, including the use of the required microfertilizers as a component part of the system of fertilization; 4) a study of the interaction of macro and microelements in the nutritional processes and in the exchange of plant substances, the effect of microelements (microfertilizers) on the extent of use and efficiency of assimilation of the principal nutrients from the soil and fertilizers.

The studies concerned with the first of the mentioned trends include the establishment of maximum values for the content of microelements in the soil and plants, the development of more improved methods for determining the forms of the microelements in the soils that are accessible to the plants, the establishment of scientifically sound gradations for supplying soils with microelements for individual soil-climatic zones and regions throughout the country, taking into account the peculiarities of the crops, the type, mechanical composition and other properties of the soils, the level of use of organic and mineral fertilizers and water regulation.

In addition to studying the effectiveness of promising forms of complex fertilizers containing microelements, considerable importance will continue to be attached for an extended period of time to developing methods for achieving more rational utilization of those waste products of industrial production which contain microelements and also to searching for a suitable microelement raw material for the production of microfertilizers.

A study of the balance between macro and microelements during extended field testing with crop rotation plans must be accompanied by a study of the effect of systematic use of high dosages of organic and mineral fertilizers, the methods employed for chemical land reclamation, chemical agents for protecting plants and the content in the soil and accessibility to plants of microelements from the soil and microfertilizers.

Deserving of fixed attention are those microelements which were not studied earlier from an agronomic point of view and also the determination of the possible negative effect of individual microelements in connection with those problems concerned with the technogenic contamination and protection of the environment.

Beyond any doubt, the trends enumerated above in the development of studies on the agrochemistry of microelements by no means encompass all of the problems associated with the subject of microelements in farming. However, they are of priority importance to the system of coordinated studies being carried out in our country for the purpose of achieving more rational use of microfertilizers, which must occupy a worthy place in the complex of measures associated with the use of chemical processes in agriculture.

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